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Bioassay of Anthropogenic Impact on the Vostok Bay (Sea of Japan) by Floristic Parameters of Macrobenthos

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Among the secondary bays of the Peter the Great Bay (Sea of Japan), the Vostok Bay was characterized as clean water area for a long time because just a small number of little settlements and farms are located on its coast and there are no industrial enterprises which could contaminate the sea with toxic substances. Ecological situation in the Vostok Bay b[a]egan to alter substantially as a result of increasing recreational load during recent 10-13 years and activation of industry since the end of 1990-s. For example, the total number of tourists in summer of 2001 was 20 thousands, but the number for June-September 2003 was more than 45 thousands.

Chemical and ecological observations, which have been conducted for the recent 4 years, allowed documenting annual increase of anthropogenic pressure on the Bay, as demonstrated by the content of dissolved oxygen, BOD_5, detergent concentration, and the number of colony-forming enterobacteria per milliliter of water (Khristoforova et al., 2002). But the indices are unstable and they reflect instantaneous image of ecological situation and in the less extent can be used to characterize long-term changes in marine ecosystems. Excellent integrators for chronic changes in the coastal seawater are macroalgae, which allow obtaining general view on the marine environment (Kalugina-Gutnik, 1989, Klochkova, Berezovskaya, 2001).

The ecological situation in the Vostok Bay was evaluated by the comparison of species composition of the macrophytobenthos and its changes for the period since the beginning of 1970-s (Makienko, 1975) to 2000-2004. To make correct comparison of our data with the 1970-s' data, depth of algae growth, places of sampling and seasons of sampling were taken into account.

Investigations were conducted during 12 integrated field works (since October, 2000 to July, 2004). Samples were collected in four depth zones: upper littoral, lower littoral, upper sublittoral (at depth to 0.5 m) and sublittoral (at depths of 1.5-26 m) zones from various types of bottom sediments.

To evaluate phytocoenoses condition, there was used a method previously applied by A.A. Kalugina-Gutnik (1975, 1989), based on correlation changes in amount of green, red and brown algae species. As it is known inreaching of the seawater by the organic matters influences phytocoenoses to change their structure and species composition. It is characterized by decrease of species quantity and predomination of green algae species (Kalugina-Gutnik, 1989, Klochkova, Berezovskaya, 2001).

In accordance with our data, during the 30 years comparatively small (7.5%) decrease in seaweed species abundance is observed; the total number decreased from 120 species (Makienko, 1975) to 111 species. Percentage of the green algae species increased from 15 to 17, percentage of the red algae decreased insignificantly (from 56 to 57%), rate of the brown algae decreased from 29 to 26%. Very intensive development of such specific polysaprobic green algae species, as *Enteromorpha clathrata* and *Urospora pennicilliformis* is observed in different parts of the Vostok Bay and this fact evidence about intensification of inshore seawater pollution (Kozhenkova, Galisheva, 2004).

Analogous changes of phytocoenoses were observed during several decades by A.A. Kalugina-Gutnik (1975) in the Novorossiyskaya Bay in the Black Sea. In particular, she determined that slight water contamination effects increase of algae species by green and red mesosaprobic algae species. By higher contamination the diversity decreases, brown algae quantity falls primarily and then Ulva and Enteromorpha phytocoenoses expansion increases.

So, anthropogenic influence to the Vostok Bay, which increased for the recent years, resulted in change of macrophytobenthos species structure, that is increase of green algae species in relation to red and brown, arising of indicator groups and species, evidencing increase of organic matters inputs.

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The main reasons of ecological deterioration within particular areas of the Bay are: an increasing number of tourists, tourist and recreation industry infrastructure development in the upper part of the Bay and activation of industry in the Gaidamak Inlet located in the western part of the Vostok Bay.

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